Artifacts

In the context of medical imaging or general signal processing, artifacts refer to interference, noise, or errors that are not part of the desired signal but can affect the accuracy of measurement results.

To understand the generation of artifacts, consider the characteristics and functions of devices like the MAX30102 sensor. The MAX30102 sensor, used for detecting signals, includes two high-intensity LEDs (one red and one infrared, each with different wavelengths) and a photodetector. These light sources alternately emit light, and the sensor measures the light reflected from the skin to calculate blood oxygen saturation and heart rate. One common source of signal interference is ambient light.

Ambient Light Interference:

- Ambient light artifacts are caused by external light sources such as sunlight and indoor lighting, which can interfere with the sensor's measurements.
- The MAX30102 relies on light absorption and reflection to measure blood oxygen saturation and heart rate. Changes in ambient light can affect these measurements, producing artifacts.

Motion Artifacts:

- Motion artifacts result from relative movement between the sensor and the skin. Such movement can cause sudden changes in sensor readings, leading to inaccurate heart rate or blood oxygen saturation measurements.
- For example, slight movements or shaking of the finger can affect the sensor's light reflection and absorption.

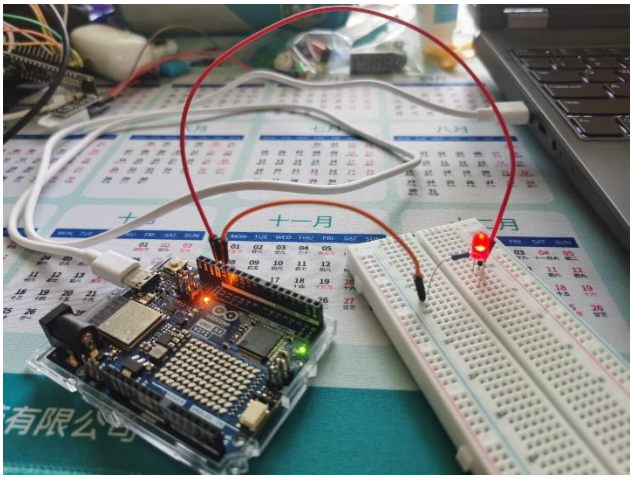
Other Artifacts Include:

- **Electrical Noise:** Many devices produce electromagnetic interference, which can affect the sensor's electronic circuits, resulting in erroneous signal readings.
- **Physiological Artifacts:** These are caused by other physiological activities in the body, such as breathing, muscle contractions, and changes in blood flow, which can influence the sensor's readings (specific to medical sensors).

Arduino & LED

First, connect your Arduino. You will need a breadboard, an LED, a resistor, and some wires. We will perform a simple experiment to make the LED blink, which helps you understand Arduino and test if it is working.

LED Connection: Use a 1k ohm resistor (blue), a red LED. Connect the short leg of the LED to GND, the long leg to the resistor, and the other end of the resistor to pin 13.



Arduino IDE Code

```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}
```

Filling Codes:

```
const int ledPin = 13; // Create a constant for the LED connected to pin 13

void setup() {
  // Setup function for initialization
  pinMode(ledPin, OUTPUT); // Set pin 13 as an output
}
```

```
void loop() {
  // Loop function runs repeatedly
  digitalWrite(ledPin, HIGH); // Write HIGH to turn on the LED
  delay(1000); // Wait for 1 second
  digitalWrite(ledPin, LOW); // Write LOW to turn off the LED
  delay(1000); // Wait for 1 second
}
```

The setup function is for initialization. When you want to initialize things, write them in the setup() function. The pinMode(ledPin, OUTPUT) line sets pin 13 as an output. This completes the setup.

In the loop function, digitalWrite is the process of writing a digital signal. Writing `HIGH` is like applying positive voltage. `HIGH = 1`, so a signal is sent to turn on the LED. Then, a delay is used to wait (1000 milliseconds = 1 second). Writing `LOW` turns off the LED. The loop repeatedly outputs `HIGH`, `LOW`, `HIGH`, `LOW`, with a 1-second interval between each state, making the LED blink.

Pin Number	Type	Function Description
D0	Digital	RX, Serial Communication Receive
D1	Digital	TX, Serial Communication Transmit
D2	Digital	Digital Input/Output, supports external interrupt
D3	Digital	Digital Input/Output, supports external interrupt and PWM
D4	Digital	Digital Input/Output
D5	Digital	Digital Input/Output, supports PWM
D6	Digital	Digital Input/Output, supports PWM
D7	Digital	Digital Input/Output
D8	Digital	Digital Input/Output
D9	Digital	Digital Input/Output, supports PWM
D10	Digital	Digital Input/Output, supports PWM, SPI SS (Slave Select)
D11	Digital	Digital Input/Output, supports PWM, SPI MOSI (Master Out, Slave In)
D12	Digital	Digital Input/Output, SPI MISO (Master In, Slave Out)
D13	Digital	Digital Input/Output, SPI SCK (Clock), connected to onboard LED
A0	Analog	Analog Input
A1	Analog	Analog Input
A2	Analog	Analog Input
A3	Analog	Analog Input
A4	Analog/Digital	Analog Input, I2C SDA
A5	Analog/Digital	Analog Input, I2C SCL
Vin	Power	External Power Input
5V	Power	5V Output Power
3.3V	Power	3.3V Output Power
GND	Power	Ground
AREF	Power	Analog Reference Voltage
RESET	Power	Reset Pin, manually resets the board